NEWS

Verdict: Hwang's human stem cells were all fakes

SEOUL

The results are in. The university committee looking into scientific misconduct in the laboratory of South Korean cloner Woo Suk Hwang announced on 10 January that his 2004 claim to have cloned a human embryo was fake. But his Afghan hound Snuppy is a real clone.

The announcement finally confirms the gravest suspicions of Hwang's work with humans. There are two papers in which Hwang's group claimed to clone human cells — a 2004 article that describes the first cloned embryo and derivation of a stem-cell line from it (W. S. Hwang *et al. Science* 303, 1669–1674; 2004), and a 2005 article that claims the establishment of eleven 'patient-specific' stem-cell lines (W. S. Hwang *et al. Science* 308, 1777–1783; 2005). Both have turned out to be complete and deliberate fakes.

AHN Y.-J./AP

At least Snuppy has been confirmed as a clone.

"Such an act is nothing other than deception of the scientific community and the public at large," concludes Myung Hee Chung of Seoul National University (SNU), who headed the committee.

With the 2005 paper already discredited in the panel's interim report (see *Nature* 439, 8; 2005), Chung's statement focused on the 2004 paper. DNA fingerprinting tests carried out by three laboratories found that the genetic material of the supposedly cloned human cell line, NT-1, did not match that of the donor. Nor did it match any of the stem-cell lines from the *in vitro* fertilization (IVF) embryos of MizMedi Hospital, which were the source for the faked data in the 2005 paper.

Further investigation revealed that mitochondrial DNA from the cell line matched one of the egg donors, but the DNA inside the cells' nuclei varied at several locations. The committee concluded that the line was derived by parthenogenesis — where the single set of chromosomes in an egg develop as if it were fertilized. The images and data in the paper that showed perfect matches were fabricated.

The committee also found that Hwang worked with a staggering number of eggs — 2,061 from 129 women — despite claiming to have used only 242 eggs for the 2004 study and 185 for the 2005 study.

The findings are a huge setback for therapeutic cloning — the idea that cloned embryos could be used as a source of patient-matched stem cells to replace damaged tissues in a range of diseases. Even using numbers of human eggs of which other researchers can only dream, Hwang's team was unable to derive such stem cells, and the field is now left with no evidence that it is possible in humans at all (see *Nature*, 438, 1056–1059; 2005).

The committee did find that Hwang succeeded in cloning human embryos to the blastocyst stage, from which stem cells can be derived. But the success rate was just 10%, and they were "in poor condition". The only other group to have some success, Alison Murdoch's team at the University of Newcastle upon Tyne, UK, has cloned just a single blastocyst (M. Stojkovic *et al. Reprod. BioMed. Online* 11, 226–231; 2005).

It is possible to create embryonic stem-cell lines, insists Kevin Eggan, a researcher in the field at Harvard University, Massachusetts. But no one will venture a guess as to when it might be accomplished. "There are many unknowns," says Eggan. "We don't know how many eggs will be needed and we don't know how many women will step forward to contribute."

Ethical transgressions in the way Hwang got his eggs — he seems to have coerced junior researchers into donating — have stim-

French research chief quits over reforms

PARIS

Bernard Meunier, president of France's basic-research agency, the CNRS, resigned on 5 January. The move brings to a head simmering internal tensions over the future of the 26,000-member body.

The CNRS has declined to comment on the resignation, apart from issuing a short statement by Meunier. In it, he makes public his disagreement over the reform plans of the agency's director-general, mathematician Bernard Larrouturou. In principle, the president defines the general goals of CNRS policy and the director-general carries them through, but in practice the latter holds the reins of power.

The reforms came into force on 1 January. They are meant to encourage multidisciplinarity, wealth creation, the development of labs outside Paris, and tighter links with French universities. The structural reforms are due to be completed later this year by a 'strategic plan' that will lay out future policies in more detail.

As a result of the reform, the CNRS's eight existing departments have been regrouped into four broad departments — life sciences, chemistry, humanities, and maths and physics — and two 'cross-cutting' departments — engineering and the environment, and sustainable development.

Meunier, a chemist, regards Larrouturou's reforms as unnecessary management interference that he believes will weaken science at the agency. He thinks that the new configuration of departments would complicate rather than simplify matters, with laboratories often belonging to several different departments at once, and he questions how the cross-

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All our news on the scandal, complete with a timeline and a guide to who's who.
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D. CYRANOSKI

Myung Hee Chung announces that claims in two *Science* papers were deliberately fabricated.

ulated an international debate over how eggs should be obtained. Eggan expects to gain approval this spring to begin human stem-cell cloning research, and he says his group will follow the US National Academies' guidelines. These stipulate that egg donors should receive no payment.

Even when admitting faked data, Hwang has maintained that his human cloning techniques are valid. But most experts say they merely involve tweaks to previously known methods, such as squeezing the nucleus out of cells rather than sucking them out with a needle. "Besides some slight adjustments, there was really nothing new," says Teruhiko Wakayama of the Center for Developmental Biology in Kobe, Japan, who created the first mouse clones in 1998.

Many experts conclude that Hwang's greatest achievement was Snuppy, the first cloned dog (B. C. Lee *et al. Nature* 436, 641; 2005). The SNU investigators verified Snuppy's identity as a clone by proving that he had the same nuclear DNA as the skin-cell donor and the same mitochondrial DNA as the egg donor — a conclusion that was confirmed on 10 January by *Nature*'s own investigation.

"Hwang merely tweaked previously known methods. There was really nothing new."

Dog ovulation produces very immature eggs, so culturing them is difficult, even for basic IVF, says Wakayama. "If it's real, this is their greatest accomplishment," he says. The SNU committee also noted that Hwang — originally trained as a veterinarian — showed greatest skill when it came to cloning animals, notably pigs and cows.

As *Nature* went to press, however, the Munhwa Broadcasting Corporation, which originally accused Hwang of faking his data, was about to air a television programme questioning Hwang's claim to have cloned a cow — the work that first shot him to fame in South Korea. The SNU committee said it was unable to confirm whether the cow was a clone because Hwang did not cooperate with them.

The committee, which issued a 50-page report covering the investigation, stopped short of accusing Hwang or other individuals on the team of deliberate fabrication. It deferred to national prosecutors who will now look into legal aspects of the case and the possibility of fraud. Hwang received huge funding from the Korean government for his work, including an annual stipend of US$3 million, which he started receiving this year as the country's "supreme scientist".

The Chung committee did report, however, that Hwang was lying when he said in November that he did not know about egg donations by his lab members. "Hwang accompanied the student to the hospital himself," the report says. Hwang later circulated a form asking for voluntary egg donation and collected signatures from female technicians.

While the committee delivered its report, a small group of supporters at the university entrance held up signs demanding that Hwang be given a chance to prove himself. "We'll put the smile back on your face," read the slogan on a familiar billboard calling Hwang the "Pride of Korea".

Chung does not agree. Hwang's team, he says, "cannot represent science in Korea". But he ends on a hopeful, if defensive, note. "We are certain that this learning experience will be a stepping stone for better execution and management of scientific research." ■

David Cyranoski

cutting departments would work.

The reforms also create five regional CNRS boards, and Meunier argues that this would add an unnecessary layer of bureaucracy, and hand excessive power to the regions, weakening scientific imperatives from central management. "He feels that it risks creating five little CNRSs," says Jacques Fossey, a chemist who is head of the research union SNCS and a member of the CNRS board of directors.

In his resignation statement, Meunier slams the reforms as "an excessively administrative network" and not the "simple and dynamic mode of functioning" that the agency needs. He adds that he hopes his resignation will lead to a new team that is "more adapted to the actions the CNRS needs to take to assure its place in French and European research". Fossey believes Meunier intended to provoke a crisis, gambling that this would force the government to remove Larrouturou and appoint a new management team.

C. LEBEDINSKY/CNRS PHOTOTHÈQUE

Bernard Meunier has resigned over changes to France's research agency.

The upset comes just as the research agency's dominant role in French science is in question. The CNRS funds its own labs, but research will increasingly be driven by competitive grant proposals administered by the National Research Agency, a body set up last year with an initial budget of €350 million (US$423 million), which will rise to €1.5 billion by 2010.

The CNRS's power would be further reduced by a long-awaited research and innovation reform bill, due to be voted on by the National Assembly next month. This would create a national Agency for Research Evaluation, responsible for looking at all research agencies, labs and scientists, a job currently done by the CNRS national committee.

As *Nature* went to press, the French government was tipped to appoint as Meunier's successor Catherine Bréchignac, a physicist and president-elect of the Paris-based International Council for Science. Bréchignac was director-general of the CNRS from 1997 to 2000, and earned a reputation as a staunch defender of the agency's autonomy. ■

Declan Butler